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STATE OF WEST VIRGINIA  
DEPARTMENT OF NATURAL RESOURCES

CHARLESTON 25305

November 16, 1976

IRA S. LATIMER, Jr.  
Director

(E77-10050) CONTRIBUTION OF ERTS-B TO  
NATURAL RESOURCE PROTECTION AND RECREATIONAL  
DEVELOPMENT IN WEST VIRGINIA Progress  
Report, 19 Jun. - 19 Sep. 1976 (West  
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NASA Scientific and Technical  
Information Facility  
Post Office Box 8757  
Baltimore/Washington International  
Airport  
Maryland 21240

Attention: Earth Resources

Subject: The fourth LANDSAT Follow-On Investigation  
Program #21260 Progress Report

Enclosed is a copy of the fourth Progress Report covering the  
reporting period from June 19, 1976 to September 19, 1976.

If you have any questions or desire additional information, do  
not hesitate to contact this office.

A handwritten signature in cursive script, reading "Ira S. Latimer, Jr.".

Ira S. Latimer, Jr.  
Principal Investigator *etc*

ISL/mlw

Enclosure

21260

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LANDSAT Follow - On Investigation Program #21260

Program Progress Report #4

Reporting Period Coverage: June 19, 1976  
September 19, 1976

Submitted by: Ira S. Latimer, Jr.  
Project Principal Investigator

Date Submitted: November 16, 1976

## I. Problems

No significant problems occurred during the fifth time period. The program's primary projects have been outlined, and two of the projects are almost complete.

## II. Accomplishments and significant Results

The LANDSAT Program has two main categories for the projects which will be done during this contract.

The first category involves the primary projects which will basically be done by the Earth Satellite Corporation. The satellite imagery will be used more with these, because of the expertise required to interpret the details necessary to make the projects' information useful.

The secondary category has all the projects that the Department of Natural Resources will do or sponsor to be done by graduate students or other agencies. These projects represent the start of the Department's objective to develop a team of remote sensing technicians who will work on "interpretive" projects for the different divisions of the DNR.

At the present time the Department of Natural Resources is cooperating or sponsoring three graduate students to do research for either Master's or Doctor's Degrees, using remote sensing techniques as an inventory tool. Most of the projects concern forest vegetation cover type studies of state parks or forests.

### A. Primary Projects

#### 1. A Satellite Image Photomosaic of West Virginia

This project is designed to use 1973 LANDSAT Imagery to construct a color composite photomosaic of West Virginia. Information concerning the mosaic is outlined as follows:

- a. Spring and summer satellite imagery is being used for the mosaic at a scale of 1:1,000,000.
- b. After the images are chosen and put together in mosaic form, the State boundaries and other important features are delineated from aeronautical charts and transferred to the mosaic products.
- c. The mosaic is then blown up to a scale of 1:500,000.

- d. Lines are drawn around things that look different on the mosaic.
- e. Names are assigned to each of the delineations.
- f. After the preliminary delineations are made, the classification system is criticized and discussed. (No reference books are used).
- g. The next step is to gather reference material and start reading about the ecology of the State. Books that were used included: Vegetation Maps of United States, by Kuchler; The Principles of Geomorphology, by Thornbury; Physiographic Regions of the United States, by Lobeck; Regional Geomorphology of the United States, by Thornbury; and Geologic, Landform, and Topographic Maps.
- h. The mosaic is then broken down into one of three land categories; Open, Wooded, and Mixed. The analysis of color tones and the proportion of color tones and the proportion of color texture on the images allows the different categories to be classified. Additional classifications have now been added for areas such as: Ridge and Valley Province; Appalachian Plateau; Allegheny Mountain, Unglaciated Allegheny Plateau; Blue Ridge Woodland, Blue Ridge - Appalachian Valley, Allegheny Woodlands, Appalachian Woodlands, Ohio River Floodplain, Parkersburg; Alluvial Farmland, Kanawha River Floodplain, Teays River Valley, South West Surface Mining District, West Central Alluvial Farmlands; Cleared, Wooded, Mixed.
- i. The final classification system is organized and final delineations have been made. The photomosaic product will be ready in two weeks.

Plans are now being made to utilize the photomosaic product as a resource data base for at least three State agencies. These agencies or divisions of agencies will hopefully utilize the mosaic product in forms of educational literature for the public.

A proposal is being organized to present to the West Virginia Department of Commerce, concerning ways in which the photomosaic can be used as a base map for types of information such as: travel brochures; specific interest brochures; industrial development study information; educational posters and charts.

Another proposal will be submitted to the DNR for the utilization of satellite imagery and U-2 photography for information brochures and posters concerning state parks and forests. The brochures should contain

color composite or color infrared pictures with important features outlined.

The West Virginia University Forestry School is doing a project concerning a "Forest Atlas" of West Virginia which should be completed in December, 1976.

2. The Wetlands Classification Project

In addition to information already discussed in previous progress reports, the wetlands project, which should be completed by October 31, 1976, can be outlined as follows:

- a. A field trip has been taken to help identify wetland species which were located from U-2 photographs. Several plants were collected and natural situations were compared to what can be seen on the photographs.
- b. The CIR U-2 photography taken in late fall is preferred for the identification of wetlands.
- c. The information that can possibly be obtained about the wetlands are: minimum boundaries, forested areas, shrub areas, glade areas, and evergreen areas.

3. The Forest Vegetation Cover Type Project

Summer and early fall imagery from the "Pocahontas County" frame of satellite imagery is being used to delineate the five different forest vegetation cover types within the region near Spruce Knob, West Virginia.

- a. The "Pocahontas Frame" of imagery from the winter of 1975 was selected for this study.
- b. The next step involves taking the imagery to the ADCOL Machine to project it and color code it in bands 4, 5, 7.
- c. Deciduous and coniferous trees can be delineated on the total frame.
- d. The picture negatives were given to the photo lab to print in a color composite at a scale of 1:250,000 and to match topo overlays that have drainage patterns and contours. (transparent overlays)
- e. Interpretation of cover types can now be done according to the proposed classification system.

- f. For additional information, use imagery from each season at either 9" X 9" format or 1:250,000.
- g. The project is 50% complete.
- h. Results from this project will be used in the "Forest Atlas" which is being organized by West Virginia University and should be completed by December, 1976.

4. The Canaan Valley - Dolly Sods Project

This project now has three main objectives which are: to provide ecological information for the naturalist program at Blackwater Falls and Canaan Valley State Parks; to provide information about a wilderness area including Dolly Sods, which is being considered for purchase as a preserved natural area; to provide valuable ecological information about the "natural significant" of the Canaan Valley Area.

The satellite imagery will be used to show regional considerations of the area at a scale of 1:250,000 such as ecozones, cities, water bodies, and unique natural features. Project Procedure and Technique Outline:

- a. CIR photography from December 3, 1973 at a scale of 1:120,000 was used.
- b. Photolab enlargements were made at a scale of 1:24,000.
- c. The U-2 enlargement was backlighted on a light table and covered with a mylar overlay.
- d. An information classification system was organized.
- e. The U-2 CIR transparencies at a scale of 1:120,000 were used to interpret information, which was transferred to the photo base map.
- f. The classification system had to be rearranged for species analysis.
- g. Three field trips were taken to identify features and signatures from the photos.
- h. A numbering system was used to delineate things such as: land use categories, vegetative species, etc.
- i. The final product will include information concerning: land use, plant communities, cultural features, and topographic information.

- j. This project should be finished within 2 weeks.

5. Strip Mine Inventory Project

There is a growing interest in the State concerning digital and computer analysis systems capabilities for land use projects. The State is rapidly changing due to industrial, and natural resource development. The primary natural resource in West Virginia is coal and it is hoped that the LANDSAT Program can contribute to some type of remote sensing system which can be of benefit to the efforts of state and federal agencies to evaluate surface mining activities.

Project Procedure and Technique Outline:

- a. The "McDowell County" frame of satellite imagery from April 23, 1976, was selected for this project.
- b. Two false color images (additive and subtractive) will be made at a scale of 1:250,000 from "bulk processed" 70mm black and white chips.
- c. The next step is to select the computer compatible tapes which cover the April 23, 1976 image and have the tapes reformatted for better spectral signatures.
- d. After the tapes are reformatted, they are taken to the Optronics Machine which produces black and white images in the different spectral bands. After these images are produced, they are filtered to create a color composite image.
- e. A photo-base map is constructed from black and white U-2 photography at a scale of 1:24,000.
- f. After the satellite and U-2 images are interpreted separately, they are compared to show the capabilities of LANDSAT.
- g. Products from the experiment: A U-2 photo-base map at 1:24,000 scale with overlays; a satellite enhanced optronics product showing the strip mines to be studied; and a satellite enhanced image showing changes from the previous images.
- h. This project should be finished within 3-4 weeks.

6. Water Impoundment Project

This project has not been started yet, but it should be organized and completed by November, 1976. The methods to be used will be similar to the ones used for the strip mine inventory project.

7. The Remote Sensing Workshop Handbook

Determined effort has begun on the organization of the West Virginia LANDSAT Remote Sensing Handbook which should be finished by November 30. This handbook will be distributed to people that attended the Remote Sensing Workshops in May, 1976, and other interested agencies in the State. It will include information such as:

- a. An Imagery Resource Catalog of West Virginia.
- b. Speaker Program Presentations.
- c. A glossary of remote sensing.
- d. A tree identification chart from the U.S. Forest Service Pamphlet on aerial photography.
- e. A photograph geometry outline.
- f. A scale conversion sheet.
- g. A booklet on Land Use and Land Cover Capabilities of Remote Sensing.
- h. A flight summary report and computer printout interpretation information.
- i. An article entitled, "Some Applications and Techniques For Making Diazo Color Composite Satellite Images.
- j. A Satellite Data Acquisition System Outline.
- k. A list of remote sensing reference books.
- l. A list of remote sensing projects in West Virginia.
- m. Color stereo pair photographs.
- n. A list of other remote sensing projects being sponsored by NASA or USGS.

8. The Ecological Interpretation Project

The Ecological Interpretation Project has been limited to giving technical assistance to the U. S. Fish and Wildlife Agency. The agency has enough background knowledge and interest to continue on their own for the water impoundment inventory projects they are doing.

B. Secondary Projects

1. Watoga State Park

This park, which is one of the largest in the State, covers an area of approximately 10,000 square acres. The park is located near Marlinton, West Virginia.

Remote sensing is being applied to this park to inventory the natural features of the park and to aid in presenting this information to the public. Satellite imagery and U-2 CIR photography are the primary sources of data.

A U-2 photography overlay map is being made to show the information that is being interpreted about the park. The project is approximately 60% completed. A satellite image map will show regional considerations about the park area.

On Thursday, August 5, 1976, a flight was made in a small aircraft to West Virginia. The mission's objectives were: a. to survey the Spruce Knob Area from the air for a vegetation cover type study, b. to take 35mm color and color infrared "comparable" photographs, and 70mm "stereo: CIR photographs of sections of the Watoga State Park Area from the air, and c. to land at Greenbrier Valley Airport and talk with Matt Pietryka, who is doing the Watoga Park inventory. The mission was successful despite "overcast" weather conditions and the photography can be rated as "average" for the 35mm pictures, and "excellent" for the 70mm stereo pictures. This mission was of great benefit because it helped to clarify techniques and procedures that are used for aerial survey work, and it will provide information that can be used in the future.

2. An educational workshop was held at the EarthSat Company August 1-6, Mike Luke from the Department of Natural Resources was sent to Washington to gather detailed information about the procedures being used and the progress of the research projects. Many things were

learned about remote sensing by actually working on some of the projects. This type of workshop will enable the DNR to expand their remote sensing capabilities for the future.

3. Most of the other state park and forest vegetation inventories have been completed. The parks that were inventoried included: Holly River, Pipestem, Lost River, and Blennerhassett Island. Along with Greenbrier and Kanawha State Forest. Some of these park and forest inventories will be expanded upon to include U-2 photograph, overlay maps, and satellite image.

4. Cooperation With The West Virginia Nature Conservancy Project

The Nature Conservancy Project is inventorying unique ecological areas in West Virginia. The results from this study will be organized into a computerized resource data base.

The classification system that the Conservancy is using has been reviewed and considered for use with the LANDSAT Program results. Modifications will have to be made, but the LANDSAT resources data will be computerized so that agencies in the State will be able to use it more effectively.

The primary reason for not setting up a classification system at this phase of the LANDSAT Program has been because the research projects have not developed to the point of demonstrating the variety of information which will be received as results of the projects.

5. Overlay Maps

The Department of Natural Resources is currently doing overlay maps on satellite color composite bulk processed, and Optronics images at 1:500,000 and 1:250,000 of the Eastern Central Mountainous and south eastern sections of the State. These overlays will contain information such as: county boundaries, major cities, major water bodies, unique cover type zones. The county boundary overlay is the only one that is completed. When these products are finished they will serve as valuable teaching aids.

6. Public Relations Projects

- a. Articles have been put in 14 newspapers throughout the State announcing the establishment of the LANDSAT Program.
- b. An article was published in the June issue of the "Wonderful West Virginia Magazine" concerning the LANDSAT Program and the use of color infrared high altitude photography.
- c. The amount of speaking engagements and educational presentations are increasing rapidly. Most of the presentations are sponsored by schools, conservation organizations, and other agencies interested in remote sensing.

7. Slide Programs

The Department of Natural Resources is currently organizing two slide-video cassette tape programs which will be available in the Department of Natural Resources Library for use by DNR personnel and other State agencies.

- a. Infrared Photography - (20-30 minutes - 50% completed) This slide program will explain the principles, techniques, and applications of infrared photography. The program should be completed by December, 1976.
- b. The West Virginia LANDSAT Program - (20-30 minutes - 65% completed) This presentation will explain the objectives of the West Virginia Program and give basic information on some of the work being done in other areas of the country.

8. Color Infrared High Altitude Photography Coverage of the State

CIR photography taken in December, 1973, has been received by the DNR. This imagery, which is available to other agencies, will provide coverage for most of the State on 1:120,000 scale. Some of the 9" X 9" transparencies and 35mm sectional slides of the U-2 frames are being used for vegetation studies. An increasing number of agencies are using this photography.

9. Potential Secondary Projects

- a. An Inventory of Cooper's Rock State Forest

The project has been approved and will follow the enclosed outline.

b. A Turkey Habitat Study

The Wildlife Division of the DNR is currently involved with a research project using telemetry methods to monitor the activities of wild turkeys in Pocahontas County, West Virginia.

The LANDSAT Program hopes to use CIR photography to determine the natural conditions of the areas inhabited by the turkeys. This information will give the biologist a better idea of the natural environment of West Virginia's most challenging game bird.

c. Using Aerial Photography and Satellite Imagery for Displays of Information Presented by the West Virginia Department of Commerce

The DNR is currently gathering information and organizing a proposal to be presented to the Commerce Department for utilizing imagery for displaying important information in travel brochures, State park directories, and on outline maps and charts.

III. Publications

No publications have been made at this time.

IV. Recommendations

No program recommendations can be made at this time.